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The AEROVOX Research Worker

The Aerovox Research Worker is a monthly house organ of the Aerovox Corporation. It is published to bring to the Radio Experimenter and Engineer authoritative, first hand information on condensers and resistances for radio work.

VOL. 16, NO. 8 AUGUST, 1944

50c per year in U.S.A.
60c per year in Canada

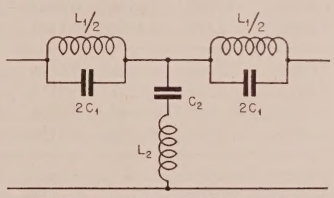
Design Data for Constant-k Band-Suppression Filters

PART V

(Parts I-IV were published in Sept.-Oct. 1942 to February 1943 issues)

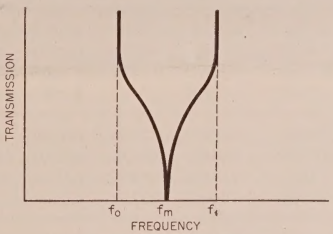
By the Engineering Department, Aerovox Corporation

THE CIRCUIT Components Chart in this article lists capacitance and inductance values for band-suppression filter sections of the constant-k type. Values are those required at twenty-three common mid-frequencies, from 100 cycles to 10 megacycles, and twelve convenient bandwidths from 0.05 to 0.9. Circuit diagram of the constant-K band-suppression filter is shown in Figure 9. Ideal response curve is given by Figure 9-A.



CONSTANT-K BAND-SUPPRESSION FILTER

FIG. 9



IDEAL RESPONSE CURVE, BAND-SUPPRESSION FILTER (CONSTANT-K)

FIG. 9-A

USE OF TABLE

Inductance listings in the table are in henries and capacitance listings in microfarads, except in the 1- and 10-Mc. columns where listings are in micromicrofarads and millihenries. All values, as read, are for band-suppression sections of 500 ohms characteristic impedance. However, component values may be found for sections having other characteristic impedance values by finding first the 500-ohm values from the table and then multiplying the listed L values by R/500 and dividing listed C values by R/500. Thus, when a given filter section is to be operated at 10,000 cycles instead of 500, the factor whereby all L values are multiplied and all C values divided becomes 10,000/500, or 20. Values of components for mid-frequencies other than those appearing in the chart heading may be obtained by interpolation, all component values being inversely proportional to the mid-frequencies.

ILLUSTRATIVE EXAMPLES

To illustrate use of the table, the following examples are offered. L and C values obtained for a constant-K band-suppression filter having a characteristic impedance of 500 ohms, bandwidth of 0.25, and operating at a mid-frequency of 2000 cycles are found from the table to be: L_1 0.0796 henry, L_2 0.0199 henry, C_1 0.0796 mfd., and C_2 0.3187 mfd. Substituting in the circuit diagram (Figure 9), each of the two shunt-circuit inductances are equal to 0.0796/2 or 39.8 m.h., while each of the shunt-circuit capacitances are equal to 0.0796/2 or 0.0398 mfd. The series-circuit inductance is 19.9 m.h., and the series-circuit capacitance 0.3187 mfd.

If it is desired to operate this filter section at some characteristic impedance other than 500 ohms, all L and C values must be modified accordingly. That is, for 5000 ohms, all C values will be divided by 5000/500 or 10; all L values multiplied by this figure. The shunt-circuit inductances each then become 398 m.h.; each of the shunt-circuit capacitances 3980 mmfd. The series-circuit inductance becomes 199 m.h.; the series-circuit capacitance 0.03187 mfd.

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CHART 3 — Constant-k Type Band-Suppression Filters (R=500 Ohms)

Band Width	f_m = 100	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
0.05	L_1 7.950	0.7950	0.530	0.3975	0.3180	0.265	0.2271	0.1987	0.1766	0.1590	0.1445	0.1325
	L_2 0.0796	0.00796	0.00531	0.00398	0.00318	0.00265	0.00227	0.00199	0.00177	0.00159	0.00145	0.00133
	C_1 0.3184	0.03184	0.02123	0.01592	0.01274	0.01061	0.00909	0.00796	0.00707	0.00637	0.00579	0.0053
	C_2 31.75	3.175	2.117	1.587	1.270	1.058	0.9071	0.7937	0.7055	0.6350	0.5773	0.5292
0.1	L_1 3.975	0.3975	0.2650	0.1987	0.1590	0.1325	0.1136	0.0994	0.0883	0.0795	0.0723	0.0662
	L_2 0.1592	0.01592	0.0106	0.00796	0.00637	0.00530	0.00455	0.00398	0.00354	0.00318	0.00289	0.00265
	C_1 0.6360	0.0636	0.0424	0.0318	0.0254	0.0212	0.0182	0.0159	0.0141	0.0127	0.01156	0.0106
	C_2 15.925	1.5925	1.0616	0.7962	0.6370	0.5308	0.4550	0.3981	0.3538	0.3185	0.2895	0.2654
0.15	L_1 2.650	0.2650	0.1766	0.1325	0.1060	0.0883	0.0757	0.0662	0.0589	0.0530	0.0482	0.0442
	L_2 0.2388	0.02388	0.0159	0.0119	0.00955	0.0079	0.0068	0.00597	0.00530	0.00478	0.00434	0.00398
	C_1 0.9520	0.0952	0.0635	0.0476	0.0381	0.0317	0.0272	0.0238	0.0211	0.0190	0.0173	0.0158
	C_2 10.60	1.060	0.7066	0.530	0.4240	0.3533	0.3028	0.2650	0.2355	0.2120	0.1927	0.1767
0.2	L_1 1.99	0.1990	0.1327	0.0995	0.0796	0.0663	0.0568	0.0497	0.0442	0.0398	0.0362	0.0332
	L_2 0.3184	0.03184	0.0213	0.0159	0.0127	0.0106	0.00910	0.00796	0.00707	0.00637	0.00579	0.00530
	C_1 1.272	0.1272	0.0848	0.0636	0.0509	0.0424	0.0363	0.0318	0.0283	0.0254	0.0231	0.0212
	C_2 7.95	0.795	0.530	0.3975	0.3180	0.2650	0.2271	0.1987	0.1767	0.1590	0.1445	0.1325
0.25	L_1 1.5925	0.15925	0.1062	0.0796	0.0637	0.0531	0.0455	0.0398	0.0354	0.0318	0.0289	0.0265
	L_2 0.3980	0.0398	0.0265	0.0199	0.0159	0.0133	0.0114	0.0099	0.0088	0.0079	0.0072	0.0066
	C_1 1.5920	0.1592	0.1061	0.0796	0.0637	0.0531	0.0455	0.0398	0.0354	0.0318	0.0289	0.0265
	C_2 6.375	0.6375	0.4250	0.3187	0.2550	0.2125	0.1821	0.1594	0.1417	0.1275	0.1159	0.1062
0.3	L_1 1.3275	0.13275	0.0885	0.0664	0.0531	0.0442	0.0379	0.0332	0.0295	0.0265	0.0241	0.0221
	L_2 0.476	0.0476	0.0317	0.0238	0.0190	0.0159	0.0136	0.0119	0.0106	0.0095	0.0086	0.0079
	C_1 1.908	0.1908	0.1272	0.0954	0.0763	0.0636	0.0545	0.0477	0.0424	0.0382	0.0347	0.0318
	C_2 5.30	0.530	0.3533	0.2650	0.2120	0.1766	0.1514	0.1325	0.1177	0.1060	0.0963	0.0883
0.4	L_1 0.995	0.0995	0.0663	0.0497	0.0398	0.0332	0.0243	0.0249	0.0221	0.0199	0.0181	0.0166
	L_2 0.636	0.0636	0.0424	0.0318	0.0254	0.0212	0.0182	0.0159	0.0413	0.0127	0.0116	0.0106
	C_1 2.548	0.2548	0.1698	0.1274	0.1019	0.0849	0.0728	0.0637	0.0566	0.0509	0.0463	0.0425
	C_2 3.975	0.0397	0.2650	0.1987	0.1590	0.1325	0.1136	0.0994	0.0883	0.0795	0.0723	0.0662
0.5	L_1 0.795	0.0795	0.0530	0.0397	0.03180	0.0265	0.0227	0.0199	0.0177	0.0159	0.0144	0.0132
	L_2 0.796	0.0796	0.0531	0.0398	0.03184	0.02653	0.02274	0.0199	0.0177	0.01592	0.0145	0.0133
	C_1 3.184	0.3184	0.2123	0.1592	0.1274	0.1061	0.0909	0.0796	0.0707	0.0637	0.0579	0.0531
	C_2 3.175	0.3175	0.2167	0.1587	0.1270	0.1058	0.0907	0.0794	0.0705	0.0635	0.0577	0.0529
0.6	L_1 0.6625	0.0622	0.0442	0.0331	0.0265	0.0221	0.0189	0.0166	0.0147	0.0132	0.0124	0.0110
	L_2 0.9560	0.0956	0.0637	0.0478	0.0382	0.0319	0.0273	0.0239	0.0212	0.0191	0.0174	0.0159
	C_1 3.820	0.3820	0.2547	0.1910	0.1528	0.1273	0.1091	0.0955	0.0849	0.0764	0.0694	0.0637
	C_2 2.650	0.2650	0.1767	0.1325	0.1060	0.0883	0.0757	0.0662	0.0589	0.0530	0.0482	0.0417
0.7	L_1 0.5675	0.0567	0.0378	0.0284	0.0227	0.0189	0.0162	0.0142	0.0126	0.0113	0.0103	0.0094
	L_2 1.116	0.1116	0.0744	0.0558	0.0446	0.0372	0.0319	0.0279	0.0248	0.0223	0.0203	0.0186
	C_1 4.44	0.444	0.296	0.222	0.1776	0.148	0.1268	0.1110	0.0987	0.0888	0.0807	0.0740
	C_2 2.272	0.2272	0.1515	0.1136	0.0909	0.0757	0.0649	0.0568	0.0505	0.0454	0.0413	0.0379
0.8	L_1 0.4975	0.0497	0.0332	0.0249	0.0199	0.0166	0.0142	0.0124	0.0110	0.0099	0.0090	0.0083
	L_2 1.272	0.1272	0.0848	0.0636	0.0509	0.0424	0.0363	0.0318	0.0283	0.0254	0.0231	0.0212
	C_1 5.08	0.5080	0.3387	0.2540	0.2032	0.1693	0.1451	0.1270	0.1129	0.1016	0.0924	0.0847
	C_2 1.990	0.1990	0.1327	0.0995	0.0796	0.0663	0.0568	0.0497	0.0442	0.0398	0.0362	0.0332
0.9	L_1 0.4425	0.04425	0.02950	0.0221	0.0177	0.0147	0.0126	0.0111	0.0098	0.0088	0.0080	0.0074
	L_2 1.432	0.1432	0.0955	0.0716	0.0573	0.0477	0.0409	0.0358	0.0318	0.0286	0.0260	0.0239
	C_1 5.72	0.572	0.3813	0.286	0.2288	0.1907	0.1634	0.1430	0.1271	0.1144	0.1040	0.0953
	C_2 1.767	0.1767	0.1178	0.8840	0.0707	0.0589	0.0505	0.0442	0.0393	0.0321	0.0294	0.0272

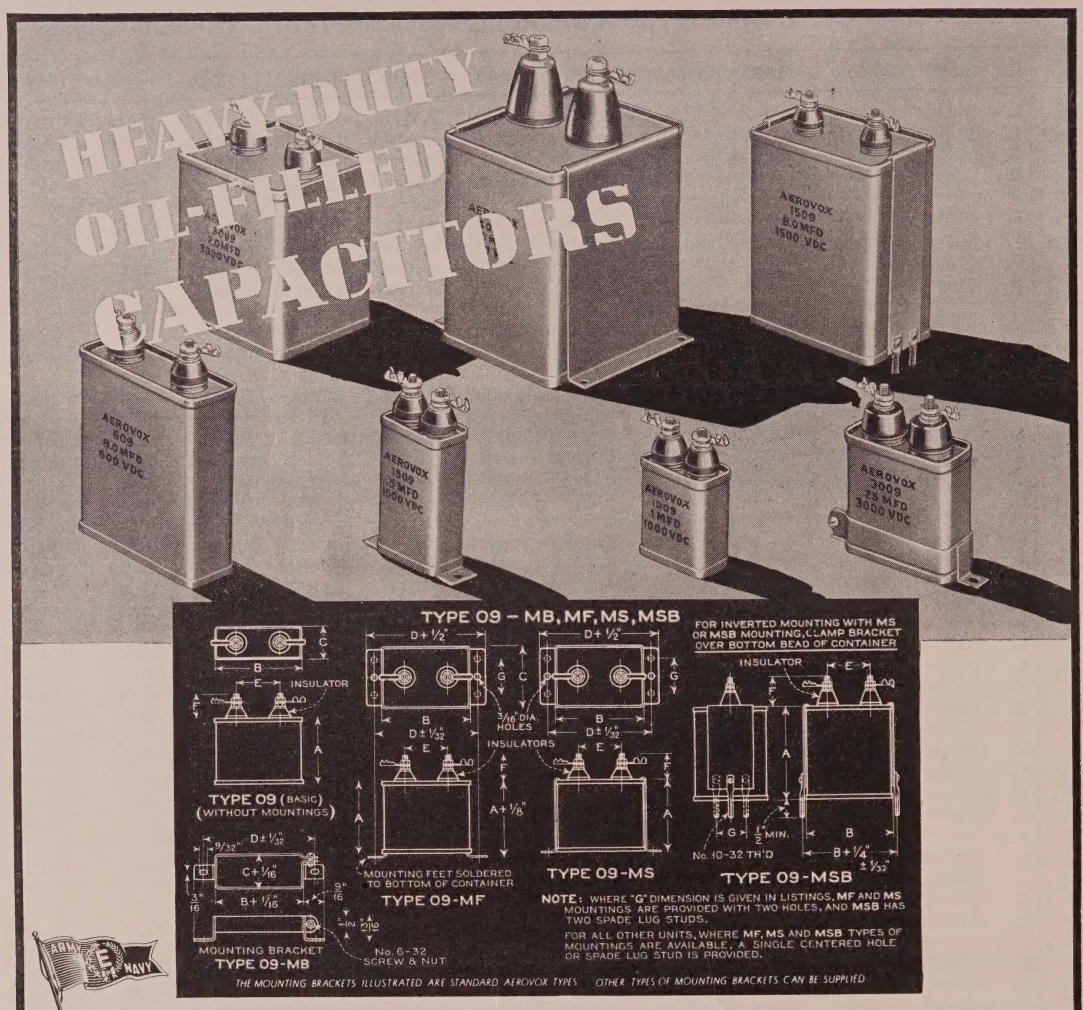
* **C**: Mmfds. in last two columns. **L**: Millihenries in last two columns. Mfds. and Henries in all other columns.

CHART 3 — Constant-k Type Band-Suppression Filters (R=500 Ohms)

Band Width	f_m = 6500	7000	7500	8000	8500	9000	9500	10 kc.	100 kc.	1 Mc.*	10 Mc.*
0.05	L_1 0.1223	0.1136	0.1060	0.0994	0.0935	0.0883	0.0837	0.0795	0.00795	0.795	0.0795
	L_2 0.00122	0.00114	0.00106	0.00099	0.00094	0.00088	0.000837	0.000796	0.0000796	0.00796	0.000796
	C_1 0.00489	0.00455	0.00424	0.00398	0.00374	0.00354	0.00335	0.00318	0.000318	31.84	3.184
	C_2 0.4885	0.4536	0.4233	0.3969	0.3735	0.3528	0.3342	0.3175	0.03175	3175	317.5
0.1	L_1 0.0615	0.0568	0.0530	0.0497	0.0468	0.0442	0.0418	0.0397	0.00397	0.3975	0.0397
	L_2 0.00245	0.0023	0.00212	0.00199	0.00187	0.00177	0.00167	0.00159	0.000159	0.0159	0.00159
	C_1 0.00978	0.00908	0.00848	0.00795	0.00748	0.00706	0.00669	0.00636	0.000636	63.6	6.36
	C_2 0.2450	0.2275	0.2123	0.1991	0.1873	0.1769	0.1676	0.1592	0.0159	1592	159.2
0.15	L_1 0.0408	0.0378	0.0353	0.0331	0.0312	0.0294	0.0279	0.0265	0.00265	0.265	0.0265
	L_2 0.00367	0.00341	0.00318	0.00298	0.00281	0.00265	0.00251	0.00239	0.000239	0.0239	0.00239
	C_1 0.0146	0.0136	0.0127	0.0119	0.0112	0.0106	0.0100	0.0095	0.00095	95.2	9.52
	C_2 0.1631	0.1514	0.1413	0.1325	0.1247	0.1178	0.1116	0.1060	0.0106	1060	106.0
0.2	L_1 0.0361	0.0284	0.0265	0.0249	0.0234	0.0211	0.0209	0.0199	0.00199	0.199	0.0199
	L_2 0.00489	0.00455	0.0042	0.00398	0.00374	0.00354	0.00335	0.00318	0.000318	0.0318	0.00318
	C_1 0.0196	0.0182	0.0169	0.0159	0.0149	0.01413	0.01339	0.01272	0.00127	127.2	12.72
	C_2 0.1223	0.1136	0.1060	0.0994	0.0935	0.0883	0.0837	0.0795	0.00795	795	79.5
0.25	L_1 0.0245	0.0227	0.0212	0.0199	0.0187	0.0177	0.0167	0.01592	0.001592	0.1592	0.01592
	L_2 0.0061	0.0057	0.0053	0.0049	0.0047	0.0044	0.0042	0.00390	0.000398	0.0398	0.00398
	C_1 0.0245	0.0227	0.0212	0.0199	0.0187	0.0177	0.0167	0.01592	0.00159	159.2	15.92
	C_2 0.0981	0.0911	0.8500	0.0797	0.0750	0.0708	0.0671	0.0637	0.00637	637.5	63.75
0.3	L_1 0.0204	0.0189	0.0177	0.0166	0.0156	0.0147	0.0139	0.0133	0.0013	0.1327	0.01327
	L_2 0.0073	0.0068	0.0063	0.0059	0.0056	0.0053	0.0050	0.0048	0.00048	0.0480	0.0048
	C_1 0.0293	0.0272	0.0254	0.0238	0.0224	0.0212	0.0200	0.01908	0.001908	190.8	19.08
	C_2 0.0815	0.0757	0.0707	0.0662	0.0623	0.0589	0.0558	0.0530	0.0053	530	53.0
0.4	L_1 0.0154	0.0142	0.0133	0.0124	0.0117	0.0110	0.0105	0.00995	0.000995	0.0995	0.00995
	L_2 0.0098	0.0091	0.0085	0.0079	0.0075	0.0071	0.0067	0.00636	0.000636	0.0636	0.00636
	C_1 0.0392	0.0364	0.0339	0.0318	0.0299	0.0283	0.0268	0.0255	0.00255	254.8	25.48
	C_2 0.0611	0.0568	0.0530	0.0497	0.0466	0.0417	0.0418	0.0397	0.00397	397.5	39.75
0.5	L_1 0.0122	0.01136	0.01060	0.00994	0.00935	0.00880	0.00837	0.00795	0.000795	0.0795	0.00795
	L_2 0.01224	0.01137	0.01061	0.00995	0.00936	0.00884	0.00839	0.00796	0.000796	0.0796	0.00796
	C_1 0.0489	0.0455	0.0424	0.0398	0.0374	0.0354	0.0335	0.0318	0.00318	318.4	31.84
	C_2 0.0488	0.0453	0.0423	0.0397	0.0373	0.0353	0.0334	0.0317	0.00317	317.5	31.75
0.6	L_1 0.0102	0.0095	0.0088	0.0083	0.0078	0.0074	0.0069	0.0066	0.00066	0.0662	0.00662
	L_2 0.0147	0.0136	0.0127	0.0119	0.0112	0.0106	0.0100	0.0096	0.00096	0.096	0.0096
	C_1 0.0588	0.0546	0.0509	0.0477	0.0449	0.0424	0.0402	0.0382	0.00382	382.0	38.2
	C_2 0.0408	0.0379	0.0353	0.0331	0.0312	0.0294	0.0279	0.0265	0.00265	265.0	26.5
0.7	L_1 0.0087	0.0081	0.0076	0.0071	0.0067	0.0063	0.0059	0.00567	0.000567	0.0567	0.00567
	L_2 0.0172	0.0159	0.0149	0.0139	0.0131	0.0124	0.0117	0.01116	0.001116	0.1116	0.01116
	C_1 0.0683	0.0634	0.0592	0.0555	0.0522	0.0493	0.0467	0.0444	0.00444	444.0	44.4
	C_2 0.0349	0.0325	0.0303	0.0284	0.0267	0.0252	0.0239	0.0227	0.00227	227.2	22.72
0.8	L_1 0.0076	0.0071	0.0066	0.0062	0.0058	0.0055	0.0052	0.0049	0.00049	0.0497	0.00497
	L_2 0.0196	0.0182	0.0169	0.0159	0.0149	0.0141	0.0134	0.01272	0.001272	0.1272	0.01272
	C_1 0.0781	0.0726	0.0677	0.0635	0.0597	0.0564	0.0535	0.0508	0.00508	508.0	50.8
	C_2 0.0306	0.0284	0.0265	0.0249	0.0234	0.0221	0.0209	0.0199	0.00199	199.0	19.9
0.9	L_1 0.0068	0.0063	0.0059	0.0055	0.0052	0.0049	0.0046	0.00442	0.000442	0.0442	0.00442
	L_2 0.0220	0.0204	0.0191	0.0179	0.0168	0.0159	0.0151	0.0143	0.00143	0.1432	0.01432
	C_1 0.0880	0.0817	0.0763	0.0715	0.0673	0.0635	0.0602	0.0572	0.0057	572.0	57.2
	C_2 0.0252	0.0236	0.0221	0.0208	0.0196	0.0186	0.0177	0.0017	0.0017	176.7	17.67

* **C**: Mmfds. in last two columns. **L**: Millihenries in last two columns. Mfds. and Henries in all other columns.

HEAVY-DUTY OIL-FILLED CAPACITORS


AEROVOX 500 8.0MFD 500 VDC
AEROVOX 1500 2.0MFD 3000VDC
AEROVOX 1500 8.0MFD 1500 VDC
AEROVOX 1500 1MFD 1000VDC
AEROVOX 3000 .75 MFD 3000 VDC
TYPE 09 – MB, MF, MS, MSB
TYPE 09 (BASIC) (WITHOUT MOUNTINGS)
INSULATOR
MOUNTING BRACKET TYPE 09-MB
No. 6-32 SCREW & NUT
MOUNTING FEET SOLDERED TO BOTTOM OF CONTAINER
TYPE 09-MF
3/16" DIA. HOLES
INSULATORS
TYPE 09-MS
FOR INVERTED MOUNTING WITH MS OR MSB MOUNTING, CLAMP BRACKET OVER BOTTOM BEAD OF CONTAINER
No. 10-32 TH'D
TYPE 09-MSB
NOTE: WHERE "G" DIMENSION IS GIVEN IN LISTINGS, MF AND MS MOUNTINGS ARE PROVIDED WITH TWO HOLES, AND MSB HAS TWO SPADE LUG STUDS.
FOR ALL OTHER UNITS, WHERE MF, MS AND MSB TYPES OF MOUNTINGS ARE AVAILABLE, A SINGLE CENTERED HOLE OR SPADE LUG STUD IS PROVIDED.
THE MOUNTING BRACKETS ILLUSTRATED ARE STANDARD AEROVOX TYPES OTHER TYPES OF MOUNTING BRACKETS CAN BE SUPPLIED

ARMY E NAVY

• **VERSATILITY**—with economy of chassis space and assembly operations a prime factor—distinguishes Aerovox Type 09 oil-filled capacitors. Although mass-produced, this type is available in such an outstanding range of voltage and capacitance ratings, as well as mountings, that it is virtually custom-made for most high-voltage heavy-duty applications.

Note particularly the choice of mounting means. Mounting means brackets shown in drawing are Aerovox standard; other types can be supplied.

Voltage ratings from 600 to 7500 D.C.W. Widest selection of capacitance values. Impregnants and fills available are HYVOL (Vegetable) or HYVOL M (mineral oil). The exclusive Aerovox terminal construction means units that pass the standard immersion tests required by various Governmental services. Terminal assembly is non-removable, an integral part of the capacitor.

These capacitors provide maximum capacitance at minimum cost. Widely used for continuous-service in transmitters, amplifiers, rectifier filters and similar applications.

• *Literature on Request*